Early Journal Content on JSTOR, Free to Anyone in the World

This article is one of nearly 500,000 scholarly works digitized and made freely available to everyone in the world by JSTOR.

Known as the Early Journal Content, this set of works include research articles, news, letters, and other writings published in more than 200 of the oldest leading academic journals. The works date from the mid-seventeenth to the early twentieth centuries.

We encourage people to read and share the Early Journal Content openly and to tell others that this resource exists. People may post this content online or redistribute in any way for non-commercial purposes.

Read more about Early Journal Content at http://about.jstor.org/participate-jstor/individuals/early-journal-content.

JSTOR is a digital library of academic journals, books, and primary source objects. JSTOR helps people discover, use, and build upon a wide range of content through a powerful research and teaching platform, and preserves this content for future generations. JSTOR is part of ITHAKA, a not-for-profit organization that also includes Ithaka S+R and Portico. For more information about JSTOR, please contact support@jstor.org.

AMERICAN AND GERMAN HIGH-SPEED TRAINS.

DURING recent years the newspapers and periodicals of Europe and America have contained numerous articles on the great speed at which French, but more especially American, express trains run. These articles, often containing exaggerated statements of the speed attained, have produced in Germany not a little unfavorable criticism of the management of the state railways for its failure to keep abreast of the best performances in train movement. To counteract the evil done by these adverse comments and to rehabilitate German railways in Germany, two contributions have recently appeared in the *Archiv für Eisenbahnwesen*, an official publication of the Prussian Ministry of Public Works.

The author, in the earlier of these articles,[1] while conceding that there are faster trains in both France and Great Britain than in Germany, nevertheless holds that on the whole the passenger train service of Germany averages better in point of speed than that of either of the other countries just named. The later article[2] is an intemperate attack on American railways and an impatient criticism of those who believe statements of train speed coming from America ("the classical land of exaggeration") that have not been fully vouched for. It contains a comparison favorable to German railways, as the earlier article did; this one showing that, notwithstanding there are several faster trains in the United States than any in Germany, yet on the whole the service in the latter country is more expeditious than in the former.

Whether or not the comparison instituted in the first article, of the speed of express trains in Great Britain and in the various

[1] "Die Fahrgeschwindigkeit der Schnellzüge auf den Haupteisenbahnen in Europa," W. SCHULZE, *Archiv für Eisenbahnwesen*, 1901, p. 124, *et seq.*

[2] "Die Fahrgeschwindigeit der amerikanischen Eisenbahnen," W. A. SCHULZE, *Ibid.*, 1901, p. 782, *et seq.*

countries of Europe is a fair one will not be considered, for the data necessary to review satisfactorily the statements made are not at hand. But the second article I have no hesitation in pronouncing unfair and grossly inaccurate. The original plaint of its author is that, in Europe, not only the populace but also those who by reason of their technical training should know better, accept statements without sufficient proof that in America trains often run at a speed per hour of 120 kilometers (75 miles) and over, yes even 193 kilometers (120 miles), and that from these statements unfair conclusions are drawn. All this is not without basis, and, had Mr. Schulze been content dispassionately to correct these exaggerated statements, so as to make a fair comparison with the railways of his own country, no one would be disposed to find fault. But he goes much farther. He attempts to discredit American railways where no disparaging comment is justified, and makes unfavorable comparisons on an incomplete examination and presentation of the facts, and he even goes out of his way to belittle American locomotives and their builders.

Mr. Schulze's article, as has already been stated, is not a direct and straightforward examination of the reports of speed said to have been attained in America. Before any specific statements of speed are taken up a large amount of inaccurate and immaterial matter, accompanied by much invidious comment, is introduced, all of which is designed to prejudice the reader against American railways so that he will be reluctant to believe anything favorable of them, and will be in a receptive mood for any comment of an adverse nature, and thus be little inclined to scrutinize any statement Mr. Schulze himself may submit. As this introductory matter, although of the greater importance, is quite beside the mark, its examination will be deferred until that part of the discussion which is directed to the point at issue has been examined. After this has been taken up, the matter passed over will be considered, for much of the material presented is so misleading that it cannot be ignored. And finally, the examination of Mr. Schulze's matter having been completed, some

tables showing American and German train-speeds and frequency of service will be submitted.

In outlining his discussion the author says, "to confirm his adverse criticisms and to show that many of the statements of very high speeds on American railways rest solely on misconceptions or on errors in computation, some convincing proof will be submitted near the end of his dissertation;" and, on introducing this proof he declares, "it now only remains to be shown by a few examples, how these incorrect statements of extraordinary speed upon American railways originate and the manner in which they are disseminated by foreign and domestic papers." [1]

The first to receive his attention are the mail trains between New York and San Francisco, about which he says:

> On the first of January, 1899, the speed of the fast mail trains between New York and San Francisco was materially increased, the particulars of the journey of the first train from New York through Buffalo, Chicago, Omaha, Ogden, and Sacramento to San Francisco were set forth in the *Railroad Gazette* of New York for the sixth of January, 1899, and the *Engineer* of London for the tenth February and the twenty-second March, 1899 — briefly in the former journal, but at considerable length in the latter. It is stated in these reports that this train, which was composed of six mail cars and a baggage car, consumed, deducting time lost in stops, only 96 hours in the whole journey to San Francisco; and, as the total distance was 3,408 miles (5,487 kilometers), the train ran at an average speed of 35.5 miles (57.1 kilometers) per hour. According to the *Engineer* the highest speed reached upon different stretches was 60 to 75 miles (96 to 120 kilometers) per hour, while, according to the *Gazette*, upon the return journey of this train one or more miles were traversed in 35 seconds each on the Chicago & North-Western railway, over a straight and level 15 miles stretch of track between the stations of Arion and Arcadia, in Iowa. That this last statement expresses the truth, is very much to be doubted, not only because the *Engineer*, in its detailed account, makes no mention of it, but also because the attainment of a speed of a mile in 35 seconds, almost 165.5 kilometers per hour, appears hardly credible. This piece of track lies between the larger stations of Missouri Valley, Denison, and Carroll. The distance between Missouri Valley and Denison is 43.4 miles (70 kilometers), and that between Denison and Carroll 28 miles (45 kilometers), and they are traversed by the fastest train scheduled in the

[1] Pp. 782, 797.

Official Guide of August, 1900, namely, the "Overland Limited Express," in 65 and 45 minutes respectively; that is, with a speed of only 64.6 kilometers from Missouri Valley to Denison, and with a speed of only 60 kilometers per hour between Denison and Carroll. It is therefore hardly thinkable that a mail train whose average speed for the whole distance between San Francisco and Chicago only equals that of the "Overland Limited Express," could, on a portion of the way, reach a speed 150 per cent. higher. And the accuracy of the report is the more to be questioned, because the *Railroad Gazette* submits its statement in indefinite form and says nothing of the way this unheard-of speed was ascertained and what, if any, precautions were taken to insure accurate results.[1]

Having shown to his own satisfaction that the great speed attributed to the fast mail train was never actually attained, Mr. Schulze directs his attention to the statement of more moderate speed said to have been developed. He declares that it appears equally incredible "that the so-called fast mail train on its journey to San Francisco could have attained a speed of 60 to 75 miles per hour (96 to 120 kilometers), as stated by the *Engineer*, because the time consumed in covering numerous portions of the journey is given, but over none of the divisions is a speed reached of 120 kilometers per hour."[2]

In introducing his last example, Mr. Schulze says:

In conclusion it still remains to be mentioned that the *Railroad Gazette* of March 22, 1901, in an article bearing the heading "120 miles an hour," reported that a mail train on the Savannah, Florida & Western railway composed of a locomotive, a mail, a baggage, and a sleeping car, on the first of March ran from Fleming to Jacksonville (149 miles) in 130 minutes, inclusive of one stop and two slow-downs, or with an average speed of 68.8 miles (110.76 kilometers) per hour. And it was further reported that near the station of Screven the stretch between the 69th and 74th mile posts was run in but 2½ minutes, that is, at a speed of 120 miles (193.2 kilometers) per hour. Because stop-watches were not used and because the time of passing each mile post was not given, the *Railroad Gazette* did not feel sure that its statements would be unreservedly accepted; but in spite of this the *Gazette* finally accepted this statement of speed as accurate [which is hardly true] because the running time taken by the traveling engineer who was on the locomotive corresponded exactly with that reported by the train dispatcher. These, even in America, unheard-of high-speed figures will for the present find no believers among us, because, according to the *Official Guide* of January, 1901,

[1] Pp. 797, 798. [2] P. 798.

the fastest train then on the railway line between Savannah and Jacksonville through Fleming (172 miles or 277 kilometers) attained an average speed of only 65.2 kilometers in one direction and 66.5 kilometers in the other, and these trains travel over the stretch of track from Jesup through Screven to Blackshear (30 miles, or 48.3 kilometers) in 42 minutes, that is, with only a speed of 69 kilometers per hour. Accordingly the mail train, on its spurt between the 69th and 74th mile posts, would have had to exceed the speed regularly attained over this track by 180 per cent. in order to reach the speed reported. In addition, the question also arises, whether it is practicable to ascertain accurately the running time over a short stretch of five miles without speed recorders. Professional testimony seems to bring this question within the bounds of propriety. In his recent work, *The Present Express Train Service* (p. 73), Camille Barbey, director of the Yverdon St. Croix railway, says: "Speed recorders are used generally only in Switzerland, where today, without exception, each locomotive is supplied with one; it is worth while wishing that their use would become general, for this would put an end to the fantastic reports of speed, running from 160 to 180 kilometers per hour, that from time to time appear in American periodicals."[1]

This example completes the evidence introduced by Mr. Schulze in support of his adverse criticisms, and in proof of his assertion that reports of very high speeds coming from America rest solely on misconceptions or on errors in computation. Whatever may be thought by others of the case made out, Mr. Schulze apparently feels that he has fully substantiated his charges. For in the concluding paragraph of his article he says:

> The examples that have been introduced sufficiently prove, as was asserted in my introduction, that the trustworthiness of all reports of speed emanating from America must first be ascertained before conclusions can be drawn as to what train speeds are possible of attainment. And this is especially true of all statements of trains dispatched at the high speed of 120 up to 160 kilometers per hour, where it is not particularly stated upon what portion of the railway the run took place, and what was the length of the trip, what was the time of departure and of arrival, and what were the number and kind of the cars, and also what guaranty there is that all the computations were correctly made, and that they were not, perchance, based entirely upon conjectural estimates or statements of the train officers or interested builders of express locomotives.[2]

I do not feel that Mr. Schulze by his criticisms has seriously impaired the standing of any of the foregoing reports of speed,

[1] Pp. 800, 801. [2] P. 801.

for the simple reason that I do not regard the speed of regular trains as a satisfactory guide to the speed attained in emergencies, and no other evidence of any weight is introduced. Yet, as I have more than once indicated, I have nothing to say in defense of the extreme records quoted by him.

I freely confess that I am also exceedingly skeptical as to their accuracy. I would not accept any statement of speed in excess of 85 miles per hour over level track, unless it was satisfactorily vouched for. And moreover, I do not believe a speed of 120 miles an hour can be attained with any locomotive now in existence except on a steep down grade, down an incline so steep in fact that the grade would supersede the power of the locomotive as the controlling factor.

Having made these admissions, the way is clear for the examination of the statements of more moderate speed and the introduction of evidence of a positive nature. Mr. Schulze says that "it appears equally incredible that the so-called fast mail train on its journey to San Francisco could have attained a speed of 60 to 75 miles per hour (96 to 120 kilometers), as stated by the *Engineer*, because the time consumed in covering numerous portions of the journey is given, but over none of the divisions is a speed reached of 120 kilometers." This statement greatly underrates the attainments of trains in America. It is conceded that a speed of 75 miles an hour is not shown over any of the divisions given in the tables of the articles quoted, but none of these divisions over the railways where the fast running was done, where the track would permit this speed, is of moderate length; and then, too, the records shown include the time consumed in getting under way and in coming to a stop. It is of course well known in this country that the fast running was done between Chicago and Council Bluffs, by the Chicago & North-Western and the Chicago, Burlington & Quincy railways, which were competitors for the mail traffic.

While neither of the railways which took part in this memorable contest kept such records of the speed attained as can be regarded as satisfactory, there can be no doubt that a speed of 75 miles per hour was often materially exceeded.

During the summer of 1900 Mr. F. A. Delano, superintendent of motive power of the Chicago, Burlington & Quincy railroad, made some tests to ascertain the extra cost of running trains at high speed. A dynamometer car was placed in the fast mail train on three of its journeys from Chicago to Burlington. On two of these journeys a speed in excess of 75 miles an hour was attained, and there was no special attempt made to obtain a record. On the second journey three successive miles were run at a speed in excess of 75 miles per hour, one being run at the rate of 79, another at 78, and another at 77.5 miles. On the third journey five miles were run at a speed of 75 or more miles an hour, the three miles over which the record was made on the preceding trip again being covered at a speed in excess of 75 miles per hour, or at 77.5, 77.5, and 77 miles respectively. These records were made between Mendota and Buda, with engine No. 1590, of the Columbia type. This engine has 18 by 26 inch cylinders, 200 pounds steam pressure, 84¼-inch drivers, and a weight on the drivers of 84,450 pounds. The train consisted of the dynamometer car and four cars loaded with mail, the total weight behind the engine tender being 376,400 pounds, or 188.2 tons.[1]

During April and May of the present year (1902) some tests were made on the Chicago & North-Western railway to ascertain the speed between stations of their fast mail trains running between Chicago and Council Bluffs. The tests were made by Mr. Robert Quayle, the superintendent of motive power, who was assisted by Mr. Percy H. Batten and Mr. Horace H. Newsom, both of whom have had considerable experience in taking records. The speed recorder used was carefully adjusted and tested in the shops, and, after being placed on the engines, was checked with a stop-watch over stretches of track that had previously been carefully measured. On many occasions a speed of 75 or more miles an hour was recorded, and on one trip a speed of 82, on another a speed of 86, and on another a speed of 89

[1] The details of these tests are fully set forth in the *Report of the Proceedings of the Thirty fourth Annual Convention of the American Railway Master Mechanics' Association*, pp. 130–135, and accompanying charts and tables.

miles per hour was attained and held for a short distance. On April 28 train No. 10, between Carroll and Boone, in Iowa, ran six miles, five of which were consecutive, at a speed of 76 or more miles an hour, and for one-half of a mile maintained a speed of 82 miles per hour. The speed over the five-mile stretch was as follows for the successive miles: 76, 78, 81.5 (.5 of this mile being at 82), 78 and 76. On May 1 the record of April 28 was surpassed, 10.5 miles, 7.5 of which were consecutive, being run at a speed of 75 or more miles per hour. On this run a speed of 86 miles per hour was attained, but was held only for a very short distance, scarcely one-quarter of a mile. The speed over the 7.5 mile stretch was at the rate of the following miles per hour for the successive miles or parts thereof, 75 (for .5 of a mile), 77, 78, 81, 84 (for 1.3 miles), 86 (for almost .25 of a mile), 83 (for .5 of a mile), 80, and 77.5. On May 10 the record of May 1 was surpassed by train number 9. Of the 202 miles between Clinton and Boone, 82.5 were covered at a speed exceeding 70 miles per hour, 13.5 at a speed exceeding 80 miles per hour and 4 miles at a speed exceeding 85 miles per hour, a speed of 89 miles per hour being reached and held for about one-fourth of a mile between the stations of Mt. Vernon and Cedar Rapids.

These runs were made with four cars, by class C Schnectady engines Nos. 218, 219 and 220, which have 19 by 26 inch cylinders, 80-inch driving wheels, and a steam pressure of 190 pounds. The weight on the driving wheels, these engines being of about equal weight, is 85,700 pounds, and that on the trucks 48,100 pounds, the total weight of each being approximately 133,800 pounds.[1]

As none of the records just introduced had been made public at the time Mr. Schulze wrote, he can, of course, not be censured for not knowing about them. But there was a record, fully vouched for, of some years' standing, which had been given great

[1] These data were furnished by Mr. Robert Quayle, superintendent of motive power of the Chicago & North-Western railway, the tracings of the speed recorder being sent to me for examination.

publicity. that he should have known of, and about which he would have been told had he made any inquiries in this country. It may be remarked that Schulze made no attempt whatever to secure information from original sources, but was quite content to call attention to small inaccuracies, or alleged inaccuracies, in newspaper reports, and to set the speed of regular trains over against the statements he wished to discredit. The run to which I refer is the well known one of 510.1 miles made by the special train of Dr. W. Seward Webb over the Lake Shore & Michigan Southern railway on October 24, 1895. Elaborate preparations were made for taking the time of this run, as it was undertaken in the hope of setting a new world's record for long-distance running. The official time-keepers were Messrs. H. P. Robinson and Willard A. Smith — the former being the editor of the *Railway Age*, and the latter sometime chief of the transportation department at the Chicago World's Fair. The train was under the immediate charge of the general superintendent of the Lake Shore, Mr. Canniff. One of the timekeepers, taking two stop-watches in his hand, started the split second hands of both with one movement of his hand, and then to one or the other of these timepieces all the other watches on the train were set. The timekeepers had agreed to relieve each other at the stop at the end of each division, one being always on duty, and the other close at hand to verify any record on which a question might arise. The timekeeper on duty sat at one of the tables, watch in hand, and opposite to him was a representative of the railway company, with no power to originate a record, but to check each stop in case an error should be made. Across the aisle sat the official recorder and a representative of the Wagner Palace Car Co., and opposite to him a representative of the daily press.

There was fast running just before Cleveland was reached, where seven miles were covered at the rate of 83.4 miles per hour, and again between Swanville and Dock Junction, where 6.2 miles were made at a speed of 84.54 miles an hour. The best running, however, was made on the last division, eight miles

being covered at the rate of 85.44 miles per hour. The most noteworthy records made on this run were as follows:

A distance of		510.1	miles at		65.07	miles	an	hour.
"	"	" 289.3	"	"	66.68	"	"	"
"	"	" 181.5	"	"	69.67	"	"	"
"	"	" 85	"	"	72.92	"	"	"
"	"	" 71	"	"	75.06	"	"	"
"	"	" 59	"	"	76.08	"	"	"
"	"	" 52	"	"	78.00	"	"	"
"	"	" 42	"	"	79.04	"	"	"
"	"	" 33	"	"	80.07	"	"	"
"	"	" 8	"	"	85.44	"	"	"

The train was composed of two heavy Wagner parlor cars, each weighing 92,500 pounds, and Dr. Webb's private car Elsmere, which alone weighs 119,500 pounds. All the engines used in this relay race were built by the Brooks Locomotive Works, after designs furnished by Mr. George W. Stevens, of the Lake Shore railway. The first four engines, which drew the train as far as Erie, were of the American type, or eight wheelers, comparatively light, but built for fast running. These engines weighed only 52 tons, had 17 by 24 inch cylinders, and 72-inch driving wheels. The last engine was of a different type, being a ten-wheeler, with three pairs of coupled drivers and a four-wheeled swiveling truck. It weighed 56.5 tons, its cylinders being of the same size as those of the other engines. Its driving wheels were only 68 inches in diameter.[1]

I believe it has now been shown, by what must be regarded as satisfactory evidence, that, while Mr. Schulze has not gone quite so far in belittling the achievements of American railways as the newspaper reporters have gone in exaggerating them, yet he has placed far too low an estimate on their performances. But possibly he should not be censured for this; for, of course, what one sets as the limit of possible achievement is largely determined by what one is accustomed to. And, this being true, it

[1] This statement was prepared from material furnished by Mr. W. C. Brown, vice-president and general manager of the Lake Shore railway, and from the description of this run by Mr. H. P. Robinson, one of the official timekeepers, as given in *McClure's Magazine* for February, 1896.

would follow that, in a country where 80.9 kilometers per hour represents the average speed of the fastest regular train, the highest speed attainable under most favorable conditions would be fixed very much lower than in a country where there are regular trains having an average speed of 107.6 kilometers per hour.

It was explained, in the introductory paragraphs of this article, that Mr. Schulze made an extended excursion before beginning the discussion of his main thesis. And it was stated that the ground covered by him in this digression would be examined after the points directly at issue had been discussed. This may now be done.

Near the beginning of his article Mr. Schulze submitted a long table purporting to give a list of the fastest trains in America. This table and the comparison based upon it form the most important parts of his article, and will therefore be commented upon at some length. In introducing it Mr. Schulze says:

> As it may be of interest I shall submit a table, carefully compiled from official sources,[1] showing the highest speed at which American trains are actually and regularly run, so that the speed of American trains can be correctly valuated, and to show also how far, in point of speed, they fall behind the unfounded statements that have been published.[2]

From this explanation it would be inferred that the table was introduced for two purposes — to furnish the data necessary to form a correct judgment of the speed attained by American trains, and to show that the speeds actually and regularly attained fall far short of the published statements. But the table was also used for another purpose, and one to which, by reason of the peculiar manner of its compilation it did not lend itself, viz., a comparison of the speed of American and German express trains.

[1] The only source of information drawn upon was the *Official Guide of the Railways and Steam Navigation Lines of the United States, Porto Rico, Canada, Mexico, and Cuba*, for August, 1900, which is published by the National Railway Publication Company, of New York, as a commercial venture. This document is not an official publication of the railway companies, and no information was obtained directly from official sources, as might be inferred from the above statement.

[2] *Archiv für Eisenbahnwesen*, 1901, pp. 781–782.

The purposes for which the author declared the table was introduced and the additional use made of it having been stated, we may examine the table and the discussion which follows its presentation. At the outset, for the sake of clearness, attention will be directed simply to the statements contained in the table to learn whether they are what they purport to be; in other words, the table will be examined merely as a statement of facts. After this has been done the shortcomings of the comparison instituted between American and German express trains will be set forth. The remaining point, the speed of regular trains as a criterion of that of special trains, having already been passed upon, need not be taken up again.

As it was impossible, Mr. Schulze says, to compute the speed of all trains because of the great mileage of American railways, he examined the trains on only the most important railways. More specifically he confined his investigations, as he says, to the ascertainment of the fastest train in either direction on the shortest of the main lines between the largest nine cities of the United States; namely, New York, Chicago, Philadelphia, Baltimore, Boston, Buffalo, Cleveland, Pittsburg, and St. Louis; the fastest trains between these cities and the federal capital; the fastest trains between Chicago and San Francisco, and between Philadelphia and Atlantic City. To obtain the running-time of the trains the time lost in stops at intermediate stations was deducted from the journey-time, and in all cases where the schedule gave merely the time of arrival at an intermediate station, or merely the time of departure, one minute was allowed for the stop, and one minute was also allowed where the schedule gave the same time for arrival and departure.[1]

As has just been stated, Mr. Schulze said, he would present only the fastest trains on the best railways between a list of selected cities. As a matter of fact, however, he does not adhere to or succeed in fulfilling his promises. The train introduced may not be the fastest, the railway selected may be only medi-

[1] P. 783. By journey-time is meant the whole time consumed by a train in making a journey.

ocre, and the route chosen may be so roundabout that no one desirous of making an expeditious journey would take it. An exhaustive review of Mr. Schulze's table, so as to point out all its defects, will not be undertaken here. Only enough evidence will be submitted to show that it has serious defects.

It is promised that the fastest train on each of the selected railways would be ascertained and then given a place in the table. But unfortunately for American railways Mr. Schulze has not always succeeded in finding the fastest train. On page 783 of his article Mr. Schulze explains that he compiled his table from the data contained in the August number of the *Official Guide of the Railways and Steam Navigation Lines of the United States* for the year 1900.[1] Many of the fastest trains, as is well known by those familiar with the contents of the *Official Guide*, are not scheduled in this document. These of course were overlooked by Mr. Schulze. Nearly all of the railways running out of our large cities have one or more mail trains that are run at much higher speed than the trains carrying passengers, which alone are found in the *Official Guide*. The Chicago & North-Western railway, for example, has three mail trains between Chicago and the union station in Council Bluffs, whose speed, as will be seen from the subjoined table, very materially exceeds that of its fastest passenger train, the "Overland Limited," which alone is mentioned in Mr. Schulze's table.

HIGH-SPEED TRAINS OF THE NORTH-WESTERN RAILWAY.[2]

Train.	Distance Between Chicago and Council Bluffs.		Average Speed While Under Way.	
	Kilometers.	Miles.	Kilometers per Hour.	Miles per Hour.
Fast Mail No. 9.....	788.7	489.9	80.3	49.9
Fast Mail No. 10.....	788.7	489.9	76.0	47.2
Fast Mail No. 15.....	788.7	489.9	72.2	44.9
Overland Limited.....	788.7	489.9	60.7	37.7

[1] Any comments I may make upon the accuracy of the contents of this table will of course be based upon the same source of information so far as it covers the points discussed.

[2] The speed of the "Overland Limited" is that given by Mr. Schulze.

In a Ineasure Mr. Schulze is excusable for not discovering the trains just discussed. But his failure at times to find the fastest train scheduled in the *Official Guide* cannot be so readily condoned, especially as Mr. Schulze lays great stress upon the importance of absolute accuracy, and is unsparing in his condemnation of those who do not attain it. The first trains in Mr. Schulze's table are those running between New York and Boston, the third in the list is one between these cities by the way of Albany. On its return journey this train is credited with an average running-speed of but 62.5 kilometers per hour. I find that train No. 15 on the Boston & Albany railway, in conjunction with train No. 50 on the New York Central, at the time of Mr. Schulze's investigations, made this journey of 555.4 kilometers (deducting time lost while standing at stations)[1] in 8 hours and 19 minutes, or at an average speed of 66.8 kilometers per hour. No. 23 of the table is a train between Chicago and Cleveland by the way of Cincinnati, and the speed of this, assumed to be the fastest train between these cities, is given as 60.9 kilometers per hour. Train No. 18, out of Chicago on the Cleveland, Cincinnati, Chicago & St. Louis railway,[2] together with train No. 46, out of Cincinnati on the same railway, made this journey of 915.6 kilometers (deducting the time lost at stations) in 13 hours and 45 minutes, that is, at an average speed of 66.6 kilometers per hour, or at an average speed 5.7 kilometers higher than is stated in the table. No. 33 of the table is a train between Philadelphia and Buffalo via Manunka Chunk, and the speed of this, supposedly the fastest train between these two cities, is given as 69.9 kilometers per hour. Train No. 311 on the Philadelphia & Reading railway, in conjunction with train No. 9 on the Lehigh Valley railway at the same date, made the journey between these two cities of 670 kilometers (deducting time lost at stations) in 8 hours and 53 minutes, or at an average speed of 75.4 kilometers per hour, a speed 5 kilometers in excess of that

[1] In the matter of deducting time, when it is not otherwise explicitly stated, I have followed Mr. Schulze's method, which was explained on p. 372.

[2] Popularly known as the "Big Four."

maintained by the train given a place in the table by Mr. Schulze. No. 35 of the table represents a train between Buffalo and Pittsburg by the way of Bradford, and the speed of this, supposedly the fastest train between these two cities, is given as 53 kilometers per hour. The route selected by Mr. Schulze is one of the longest, if not the longest, of the lines connecting these two cities, and the train selected, although the fastest over this (indirect) route, is not so fast as the best train on several of the other more direct lines. Train No. 11, out of Buffalo on the Lake Shore & Michigan Southern railway, and train No. 211, out of Ashtabula over the same railway, together with train No. 18, out of Youngstown on the Pittsburg & Lake Erie railway, together making a through train, made the 418.6-kilometer journey between Buffalo and Pittsburg (deducting time lost at stations) in 6 hours and 45 minutes, that is, at an average speed of 62 kilometers per hour, or at an average of 9 kilometers more per hour than is stated in the table. It would require much less time to go by the roundabout way of Cleveland and Youngstown over the Lake Shore & Michigan Southern, the Erie, and the Pittsburg & Lake Erie railways, than by the route selected by Mr. Schulze. These examples show that Mr. Schulze's table has serious defects, and that his results cannot be accepted without verification.

It has now been seen in what measure the promise to introduce only the fastest trains is fulfilled. Let us see if greater success is attained by Mr. Schulze in the selection of railways; for it will be remembered that the author professes that only the fastest trains on the best railways are given a place in the table. The second group of Mr. Schulze's table, numbers 4 to 8 inclusive, comprises the trains between New York and Buffalo. The following railways are represented: New York Central & Hudson River railroad, with a train having an average speed for the whole journey of 87.2 kilometers per hour; Lehigh Valley railroad, with a train having an average speed of 76.5 kilometers per hour; Delaware, Lackawanna & Western railroad, with a train having an average speed of 70.1 kilometers per hour; West

Shore railroad, with a train having an average speed of 65.5 kilometers per hour; and finally the Erie railroad, with a train having an average speed of 65 kilometers per hour. It would be needless, even if the speed of the trains on the respective railways had not been given, to explain to American readers that these railways are not of the same rank, and this fact should have been realized by Mr. Schulze after his computations were made. Instead of including only the best railways he has introduced all the railways between New York and Buffalo, except the Pennsylvania, whose line is exceedingly roundabout. This point may not at present appear to be of much significance, but it is really of great weight, as will be seen later, where the average speed of the fastest trains on what are said to be the best railways of America is compared with the average speed of the fastest trains in Germany. In such a comparison, of course, the trains selected to typify the different countries becomes a matter of the first importance, but this is anticipating my argument. No more illustrations will be introduced to show how unfortunate Mr. Schulze's selections were; but it is not to be inferred from this fact that in all other cases only the best railways are given a place in his table; such, in fact, is not the case, as could readily be shown were it worth while.

It was not only stipulated that only the fastest trains on the best railways would be included in the table, but also that only the fastest trains on the best railways having the most direct routes would be found there. If the last qualification were rigidly adhered to, some of the fastest trains would be excluded, for the fastest trains are often found on the longer lines. The trains of the best railways running between any two large cities usually make the journey, by agreement, in the same or about the same time, regardless of the distance that must be traveled; witness the limited trains between Chicago and New York on the Lake Shore & Michigan Southern, and New York Central & Hudson River railways on the one hand, and the Pittsburg, Fort Wayne & Chicago, and the Pennsylvania railways on the other hand. But here again Mr. Schulze did not live up to his profes-

sions. He did not confine himself to the fastest trains on the most direct routes, and did not omit any specially fast train because it ran in a roundabout way. But he did include several trains whose routes were very indirect and whose average speed was relatively very low. For example, who, if he were in haste, would think of going to Boston from New York by the way of Albany, or who would go to Cleveland from Chicago by the way of Akron? The latter journey, on the train cited by Mr. Schulze, would involve changing cars at Chicago Junction, Ohio, a journey from there on a local train to Akron which makes seventeen stops in the short distance of 74.5 miles, or one every 4.4 miles, and a journey on a slow train from Akron to Cleveland. These errors and those cited in the preceding paragraphs show that Mr. Schulze's table contains many very serious imperfections and omissions.

Although the inaccuracies already pointed out quite destroy the value of the table, there yet remain a number of further errors of such importance as to call for comment. Those that have just been discussed were due, it may be said, to a lack of care, while the further faults that must receive attention may be attributed to a want of knowledge of conditions existing in America. Mr. Schulze's table contains many trains which either begin or end their journey in New York city. Of the 42 trains found in the table, 18 start from New York city, and of these 5 leave over the New York Central & Hudson River and the New York, New Haven & Hartford railways, and therefore really start from New York city. The remaining 13 trains do not start from New York city, but from the New Jersey shore, the passengers crossing the Hudson river on ferryboats. Now, the schedule time of departure from New York city is the hour the ferryboat leaves, and it is hardly fair to charge this time to the train which is waiting on the other side of the river. It seems the more unfair to do this because the distance across the river is generally not added to the mileage actually run by the train.[1] To all trains this addition of from 13 to 15 minutes to

[1] This fact should have been a sufficient hint to Mr. Schulze that he would err if he took the New York city time as the time the train departed.

their running time is a matter of some importance, and to the short distance trains is a matter of great moment. For example, train No. 85 for Philadelphia, on the Pennsylvania railroad, is scheduled to leave Desbrosses street, and Cortland street also, at 4 P. M., but, as a matter of fact, the ferryboats leave at 4 o'clock, the train starting from Jersey City at 4:13 P. M. Here, then, is an error of 13 minutes in the time of the departure of this train, and, as the run is a short one, the speed of this train consequently is very materially understated. Mr. Schulze, allowing 3 minutes for three stops, reports that it runs at an average speed of 75.4 kilometers per hour, while it really runs, allowing 2 minutes for two stops, at an average speed of 82.6 kilometers per hour. This example is sufficiently convincing, especially when it is remembered that 13 of the 42 trains altogether cited by Mr. Schulze are affected by this error at New York alone, and that there are others affected by a like error at Philadelphia, Detroit, and San Francisco. It shows how the value of Mr. Schulze's table is impaired by his lack of knowledge in this one respect.

One comment on the table yet remains to be made. Where the *Official Guide* merely gave the time of arrival at or merely the time of departure from intermediate stations, and in all cases where the train was scheduled to depart the same instant it was scheduled to arrive, Mr. Schulze allowed one minute for the stop. In Europe this allowance may be sufficient, but it is not so here. For example, according to the table, the "Overland Limited" of the Chicago & North-Western railway, loses but 25 minutes in stops between Chicago and Omaha, while in point of fact it loses 96 minutes. There are 25 stops, instead of 17, as shown in the table. A number of the stops which were assumed to be but one minute each in length actually lasted several minutes. For example, there is a stop of 5 minutes at Clinton, and one of 6 minutes at Cedar Rapids, for which together only 2 minutes were allowed. According to the *Official Guide* 35 minutes are consumed in going from Council Bluffs to Omaha, a distance of only three miles; but, as a matter of fact, all but 12

of these 35 minutes are lost at Council Bluffs and the Union Pacific transfer, 12 minutes being an abundance of time to run the three miles. At these four stops a total of 30 minutes is lost, over what Mr. Schulze allowed. The long delay at the Union Pacific transfer is due to the fact that the train is here made ready for the initial portion of its journey across the plains.[1] If 96 minutes, the actual time lost in stops, be deducted instead of 25 minutes, the time allowed by Mr. Schulze, the average speed of the "Overland Limited" between Chicago and Omaha will become 66.6 kilometers per hour, instead of 60.7 kilometers, as given by Mr. Schulze. This difference of 5 kilometers shows that the rule of rough approximation adopted produces variations from the true figures so wide that the results obtained cannot be accepted.

We may now turn from this examination of the table, undertaken to ascertain if it was compiled in conformity with the author's stipulations, to the comparison instituted between German and American express trains.

> A comparison [Mr. Schulze says] of the table just discussed, showing American express-train speeds, with the table appearing on page 124 *et. seq.* of the *Archiv für Eisenbahnwesen* for 1901, giving the average speed of the express trains of Germany, will show, if the fast trains between Philadelphia and Atlantic City, which are run under special conditions, be dropped out of consideration, not only that equally high average speeds are reached, but even higher averages are attained than in America.

According to these tables an average, Mr. Schulze says, in excess of 65 kilometers per hour is attained by only 26 trains in America, while this speed is attained or exceeded by 36 trains in Germany.[2]

For many reasons, some of which have already been indicated, the comparison here instituted by Mr. Schulze is of very slight value, if any. First of all it should be understood that it is really not a comparison of the average train speed of America with that of Germany, for the average of neither country has

[1] These facts were furnished by Mr. R. H. Aishton, general superintendent of the Chicago & North-Western railway.

[2] *Archiv für Eisenbahnwesen*, 1901, p. 796.

been computed. The table for America contains but 42 trains and that for Germany but 46; so that it is nothing short of the absurd to speak, on this basis, of German express-train speeds averaging higher than American.

For the time being let it be assumed that the table for America is free from the many serious omissions and inaccuracies pointed out in the preceding paragraphs. With this assumption in mind, do the tables warrant the conclusion drawn from them by Mr. Schulze? This question can only be answered in the negative, for the tables are not comparable.

Before calling attention to Mr. Schulze's errors and omissions it may be asked why the trains between Philadelphia and Atlantic City are altogether omitted from the comparison. To be sure, the very fastest trains on both of the railways concerned did not run during the winter months at the time Mr. Schulze wrote; but this is not a sufficient reason for dropping the trains between these two cities entirely out of the comparison, for there were several trains over each of the railways whose average speed, both winter and summer, exceeded Mr. Schulze's figures of 65 kilometers per hour. Mr. Schulze was aware of this, for at another point he states that a winter train on one of the railways had an average speed of 89.4 kilometers per hour, and one on the other railway an average speed of 82.6 kilometers.[1] Even the lower of these speeds is higher than that attained on any German railway in the comparison.

As has already been stated, the territorial scope of the two tables is not coextensive. The one for Germany was said to contain, and in all probability does contain, the fastest trains in the whole empire, regardless of the cities between which they run, while the table for America only contains the trains between a few cities.

It will be remembered that Mr. Schulze explained that the task of computing the speed of all American trains was so great that he would not attempt it. To bring his labors within what

[1] *Archiv für Eisenbahnwesen*, 1901, p. 794.

he deemed proper bounds, he confined his investigations to the railways between a few large cities. Consequently the table, even if this limited field had been properly covered, would have had but slight value for comparative purposes. Many of the most important lines received no consideration whatever. For example, the great railways radiating north, west, and southwest, and at least one running south, from Chicago, the second city of the union in population, were wholly ignored; with the single exception of the Chicago & North-Western railway, whose Chicago-Council Bluffs line was represented by the "Overland Limited," a train whose speed, as I have shown on page —, is exceeded by three other trains over the same track. These railways, centering in Chicago, have many trains in the aggregate between Chicago, on the one hand, and Milwaukee, Madison, Cedar Rapids, Rock Island, Des Moines, Burlington, Council Bluffs, Ft. Madison, and Champaign, on the other hand, that have an average speed in excess of 65 kilometers per hour. Even the excellent service between Chicago and Milwaukee on the Chicago & North-Western and on the Chicago, Milwaukee & St. Paul railways received no consideration at Mr. Schulze's hands.

For the comparative purpose for which it is used, the table of American trains is unsatisfactory for still other reasons. It does not include all the trains between the few cities that were selected by Mr. Schulze having an average speed above 65 kilometers per hour. A place in the table should have been given to train No. 43, between Boston and New York, via Springfield, over the New York, New Haven & Hartford and the Boston & Albany railways, with an average speed of 69.1 kilometers per hour; to train No 24, between Cleveland and Pittsburg, via Youngstown, over the Erie and the Pittsburg & Lake Erie railways, with an average speed of 66.8 kilometers per hour; to train No. 503, between New York and Pittsburg, via Baltimore, over the Royal Blue line,[1] with an average speed of 66.4

[1] The Pennsylvania is erroneously stated by Mr. Schulze to be a link in this line.—*Archiv für Eisenbahnwesen*, 1901, p. 795. He should have said "Philadelphia & Reading railway."

kilometers per hour; and to train No. 311, between Philadelphia and Buffalo, over the Philadelphia & Reading and the Lehigh Valley railways, with an average speed of 75.4 kilometers per hour. These are a few of the many trains that must be taken account of to make the comparison effective, even for the limited district it was said to cover.

A comparison of the two tables is misleading for another reason. In the case of all German trains the average speed per hour of runs without a stop, of 90 kilometers or more, is also given, and this speed, when higher than the average speed maintained between the termini, was taken as the average speed of the train, while in the case of the American trains this additional information was generally given only in case of the *fastest* trains. This special treatment carried six German trains from the group having a speed of less than 65 kilometers per hour into the group having an average speed of 65 or more kilometers per hour. At the same time the average speed between termini of several of these trains fell considerably below 65 kilometers per hour. Only three American trains were lifted over the dividing line by the use of this device. Had the *slower* American trains been accorded as favorable treatment as the German trains, few if any of them would have been found in the class showing a speed of less than 65 kilometers per hour.

By still another device German train service is made to appear to much better advantage than it deserves. Several of the fastest German trains are broken up, and thus each one counts for two or more trains. For example, the "Orient Express," which runs through Germany from Avricourt to Salzburg, a distance of 659 kilometers, appears in the table three different times; the "North and South Express," which runs from Berlin to Kufstein, a distance of 753 kilometers, appears in the table two different times; the "North Express," on its journey from Herbesthal to Hannover, a distance of 410 kilometers, appears to be counted as two different trains; and a Berlin-St. Petersburg express, on its journey from the former city to Eydtkuhnen, on the German frontier, a distance of 742 kilometers, appears in the table as two different trains.

It is misleading to count each one of these trains in the comparison as two or even three trains, while the "Lake Shore Limited," running from Chicago to New York, a distance of 1,578 kilometers; the "Pennsylvania Limited," running between the same cities; the "Overland Limited," running from Chicago to San Francisco, a distance of 3,895 kilometers, each counts as but a single train. This is especially true of the "Overland Limited;" for, at the time Mr. Schulze wrote, it ran over three entirely independent railways, namely, the Chicago & North-Western, the Union Pacific, and the Southern Pacific.

The possibilities of train multiplication, should this divisional method be applied to American railways, can be inferred from an examination of one of the trains just cited. If the "Lake Shore Limited" were treated the same as the "Orient Express," it would yield seven trains instead of but one.

While these examples show great diversity of treatment, there are other instances in the tables which show even greater discrepancy. No. 23 of the American table purports to be a train from Chicago to Cleveland by the way of Cincinnati—a route, by the way, over which, it is needless to say, no one travels. To make this journey would be like going from Brussels to Berlin by the way of Zürich. Of course, no one train makes this whole journey; an entirely different train makes the trip from Cincinnati to Cleveland than the one which starts from Chicago. The integration of these two trains in the table appears doubly misleading, because, while no two trains over the same railway making a good connection at Cincinnati ran the entire distance of 916 kilometers at an average speed in excess of 65 kilometers per hour, there were at the same time two trains, one running from Chicago to Cincinnati over the "Monon" route, and the other from Cincinnati to Cleveland over the "Big Four," but making an indifferent connection at Cincinnati, each of which exceeded this speed. The method of treatment employed by Mr. Schulze yielded no train of sufficient speed to receive consideration; the other would have yielded two. Of course, I do not wish to be understood as intimating that this discrepany

explains why the two trains over this exceedingly roundabout route were linked together in this manner.

What is a fair basis of comparison? a basis upon which the train service of one country can be contrasted with that of another? That these are pertinent questions the preceding paragraphs have abundantly shown. No comparison of any value can be instituted until the things compared have been reduced to a common unit. I shall not attempt to point out in detail the factors that must be harmonized to secure valuable results, for most of them will appear at once to anyone of a judicial mind. A few of these factors, however, must be briefly dwelt upon.

In the comparison instituted by Mr. Schulze the element of distance does not receive any consideration. For the most part the American trains selected by him ran between cities widely separated. This is shown by comparing the distances run by the trains found in the German and the American table. The aggregate distance traversed by the 42 American trains was 34,791 kilometers, and the average distance was 828 kilometers, while the total distance run by the 46 German trains was but 14,540 kilometers, and the average distance was but 316.1 kilometers. Distance affects speed in two ways. Great stretches of track without sharp curves and free from mountain ranges to be overcome, wide rivers to be crossed, perhaps ferried, and large cities to be passed through, are rare, and it is therefore much more difficult, from the physical point of view, to maintain a high speed over a great distance. For instance, the "Overland Limited," one of the trains selected by Mr. Schulze, must cross, on its journey from Chicago to San Francisco, two wide rivers and three mountain ranges, and, finally, a wide bay by ferry. Some idea of the grades to be overcome may be inferred from the elevations above the sea of the following places which are successively passed through on a westward journey to the Pacific coast: Omaha, 1,031 feet; Sherman, on the continental divide, 8,247; Green River, 6,077; Aspen, 7,395; Ogden, 4,301; Summit (at the top of the

Sierras), 7,017; and San Francisco, 14. The trains running between the cities of the Atlantic coast and those of the Mississippi Valley must cross the Alleghany mountains and their outlying elevations, and several must be ferried across the Detroit River. These examples should show how difficult it is to maintain a high average speed for the great distances cited by Mr. Schulze, and should suggest how necessary it must be for the purpose which he has in view, to eliminate great natural and artificial obstacles by breaking up long runs and dropping from consideration stretches of track which for any reason are unfavorable to the maintenance of high speed.

In the preceding paragraph it has been shown that physical obstacles are likely to intervene and render impossible the maintenance of high average speed for a great distance. A regard for the convenience of the greatest possible number of travelers often makes it undesirable to maintain a uniform high speed between distant points, even where physical obstacles do not prevent. There are hours of the day, but more especially of the night, when passengers do not care to take or leave a train. Trains must arrive at, and depart from, the great centers of population at such hours as will least interfere with the transaction of business and promote in the largest degree the comfort of those who travel.

A schedule of trains made up in conformity with these considerations will show great variations of speed over different sections of track by trains which have about the same average speed between the distant termini. One train may run over one division at a high rate of speed, and another may attain its highest speed over another portion of track or between different cities. The speed attained will depend upon the particular set of patrons whom the train is intended to serve. This being so, it becomes apparent that a small unit of distance is much more likely to show a great number of high-speed trains than a large one.

That this is true is made clear by the following table of trains between St. Louis and Pittsburg. Train No. 2 is the

one selected by Mr. Schulze. The computations are made on the basis adopted by Mr. Schulze, as explained on page 372, and the data are taken from the source of information cited by him.

TRAINS FROM ST. LOUIS TO PITTSBURG.

(Via P., C., C. & St. L. R. R.)

Train Number.	St. Louis to Pittsburg.		Divisions.			
			St. Louis to Indianapolis.		Indianapolis to Pittsburg.	
	Distance,[1] Kilometers.	Average Speed per Hour, Kilometers.	Distance, Kilometers.	Average Speed per Hour, Kilometers.	Distance, Kilometers.	Average Speed per Hour, Kilometers.
2	988.5	61.8	386.4	**66.4**	602.1	58.9
14	988.5	57.9	386.4	49.2	602.1	**65.3**

This table makes it apparent that the best showing can be made by breaking up long routes into short ones, a procedure which makes it possible to select different trains for different sections of track. According to the method of computation adopted by Mr. Schulze, there was no train over this route having an average speed so high as 65 kilometers per hour. While the method followed in the table, which was the one used by Mr. Schulze in computing the speed of German trains, shows two trains having a speed in excess of 65 kilometers per hour, Train No. 14 being a night train out of St. Louis, there is no need for haste in getting to Indianapolis, as this city can easily be reached at as early an hour in the morning as the passengers will care to leave the train, and consequently the train drags along at rate of but 49.2 kilometers per hour. Train No. 2, on the other hand, is an afternoon train, and there is no time to lose if Indianapolis is to be reached early in the evening, so the train is pushed along at an average speed of 66.4 kilometers per hour.

It does not appear to me that much light can be thrown upon

[1] Mr. Schulze gives this distance as 1,000 kilometers. This is an over-statement: these trains run via Dayton, not via Bradford Junction, as assumed by him.

the comparative value of the train service rendered in different countries by the method here followed by Mr. Schulze. The computation of the average speed per hour of all the trains of the countries under consideration being out of the question, because of the magnitude of the work involved, it must be admitted that a more satisfactory answer than that obtained by Mr. Schulze to the question whether the train service of one country is better than that of another can be found in a thorough comparison of the service between a few cities. Such a comparison would not only be qualitative, but quantitative as well. Obviously, if in one country twice as many trains at a given rate of speed are run over the selected railway as in another country, a comparison which turns upon the rate of speed alone is faulty in method.

To obtain valuable results the cities must be separated by approximately equal distances, the country traversed must have the same physical characteristics, and the cities chosen must be as nearly equal in population as can be, or they must be on routes of travel of equal importance. Strange to say, the plan just outlined was followed by Mr. Schulze in the comparisons made by him of the train service of Germany, France, and Great Britain,[1] and why the same method was not employed by him in contrasting the speed of American and German express trains is not apparent.

On the following page a table will be found showing the number and speed of the trains on two German and two American lines. The German lines are those between Berlin, the imperial capital, and Hamburg, the next largest city, and between Berlin and Cologne, which is one of the great western gateways of travel. The American lines are those between New York (Jersey City)[2] and Washington, and between New York and Buffalo. The service on these lines fairly reflects the best service of the respective countries for medium and long-distance runs. At any rate the German lines are those selected by Mr.

[1] *Archiv für Eisenbahnwesen*, 1901, pp. 144–151.

[2] All of the trains for Washington start from the western shore of the Hudson, as do many of those for Buffalo.

Schulze for comparison with French and English trains, and it may therefore be assumed that they represent the best service that can be found in the empire. It is to be noted that in each case the run of the American train is materially longer than that of the German train. In this table only the trains running in one direction are given. The distance given at the head of the columns is the short-line distance; the other distances can be found in the more detailed tables which follow. To enable the eye to grasp the figures easily they are grouped by rates of speed, beginning with the highest speeds. The speed of the trains has been computed on the basis adopted by Mr. Schulze, and explained on page 372 of this article. If any points still remain in doubt, they will probably be found explained in the introduction, beginning on page 44, to the detailed tables.

EXAMPLES OF GERMAN AND AMERICAN TRAIN SPEEDS.

Average Running-Speed per Hour.

Medium Distance Trains.				Long Distance Trains.			
Berlin to Hamburg, 178 Miles, or 286 Kms.		New York to Washington, 224 Miles, or 361 Kms.		Berlin to Cologne, 358 Miles, or 576 Kms.		New York to Buffalo, 409 Miles, or 658 Kms.	
Miles.	Kms.	Miles.	Kms.	Miles.	Kms.	Miles.	Kms.
50.2	80.9	50.2	80.8			54.2	87.2
50.1	80.6	50.2	80.8			48.2	77.6
49.8	80.2	50.1	80.6			44.2	71.2
		48.4	77.9	43.3	69.8	43.1	69.5
		48.1	77.4	42.6	68.6		
		47.9	77.1	42.0	67.6	42.1	67.8
		46.6	75.0	42.0	67.6	41.8	67.3
		46.5	74.9			41.8	67.2
		45.7	73.5			41.1	66.1
45.5	73.3	45.6	73.4	40.8	65.7	40.9	65.9
		44.8	72.0			40.9	65.9
		44.2	71.2	39.9	64.2	40.1	64.5
		43.5	70.1	39.8	64.1	40.0	64.3
		43.1	69.5			39.9	64.1
		42.7	68.8	39.6	63.8	39.7	63.9
		42.6	68.7			39.4	63.5
		42.5	68.4			38.8	62.5
		42.5	68.4			38.0	61.2
		42.1	67.8	37.6	60.6		
		41.8	67.4				
40.0	64.3						
38.6	62.2						
36.3	58.4						

If the service on the routes selected is typical of that of the two countries under consideration, it is obvious that the train service of American railways is greatly superior to that of the German railways. The trains are not only run at a higher rate of speed but much more frequently than on the German railways. Both American routes are longer than the corresponding German routes, and the physical obstacles to be overcome are greater. The average speed of the seven trains running from Berlin to Hamburg is but 71.4 kilometers per hour, while the average speed of the best seven trains running from New York to Washington is 78.5 kilometers per hour, and the average speed of the twenty express trains running between these cities is 73.2 kilometers per hour. The average speed of the nine trains running from Berlin to Cologne is but 65.8 kilometers per hour, while that of the best nine trains running from New York to Buffalo is 71.1 kilometers per hour, and the average speed of the seventeen express trains running between these cities is 67.6 kilometers per hour.

The second point, and the one to which I wish especially to direct attention, is the greater number of high-speed trains on American railways. It was originally contended that a route over which but one fast train runs daily should not count for as much in a comparison as a route over which several fast trains run. The facts presented in the table illustrate and emphasize this point. It will be remembered that, in the comparison instituted by Mr. Schulze, trains which reached or exceeded a speed of 65 kilometers per hour, were called fast trains. Applying this standard to the trains of the foregoing table, we find there are 20 fast trains running over the two routes from New York to Washington, and but 4 fast trains running over the one route from Berlin to Hamburg; and we find that there are 10 fast trains running over the 5 routes from New York to Buffalo, and but 5 fast trains running over the four routes from Berlin to Cologne. The contention that a comparison to be of value must be quantitative as well as qualitative has been made clear by this table.

The true character of the service over a line of railway does not appear from a single train. In England and Germany, but more especially in France, and several of the other countries of Europe, the train service indicates the social strata found in these countries. There are a few fast trains for the well to do who pay very high rates, but very slow trains with inferior equipment for the ordinary traveler. To be sure excess fares must be paid on several American trains, but they are very few in number, and the present tendency is decidedly toward a uniform rate for all trains. American readers, at least, need not be told that the strong lines between the east and the west would gladly introduce a uniform rate, and are only prevented by the opposition of the weaker lines. In the West the same spirit prevails. Sooner than concede the excess-fare principle for fast trains, the Chicago & North-Western railway, which recently cut down the running time between Chicago and Omaha of its "Overland Limited" train fifty minutes, upon the demand of those who were either unable or unwilling to make a corresponding reduction of time, practically restored its train to its old schedule.

In the succeeding tables detailed information will be found as to the trains whose speed is given in the preceding table. The first column, in the case of American trains, shows the number by which the train is designated by the company operating it. Officially the train is always designated by this number, although it may be popularly known by some name such as the "Overland Limited" or "Colorado Special." In the case of the German trains the first column simply shows the running number. The second column indicates the route over which the train runs. This is done either by giving the name of the company operating the train, from which the route can be inferred, or by giving the names of a few cities determinative of the route. It was thought that the former method would be more satisfactory in reporting American trains, as it would give most persons a general idea at least of the route followed. The third and fourth columns show the length of the route traversed by the train immediately under consideration. Care has been taken in ascertaining these

distances, for in the case of the short-distance trains a slight error in mileage would materially affect the computed speed of the train. It is to be noted that the through trains between New York (Jersey City) and Washington on the Pennsylvania railroad run to the Union station in Baltimore. The distance from this

EXPRESS TRAINS FROM BERLIN TO HAMBURG.

Number.	Route.	Whole Distance.		Time of		Journey Time.		Station-Stops.		Running Time.		Running Speed per Hour.	
		Miles.	Kilometers.	Departure.	Arrival.	Hours.	Minutes.	Number.	Time Lost.	Hours.	Minutes.	Miles.	Kilometers.
1	Via Wittenberge.	178	286	6:30	10:06	3	36	1	4	3	32	50.2	80.9
2	" "	"	"	7:20	10:58	3	38	1	5	3	33	50.1	80.6
3	" "	"	"	1:17	4:57	3	40	2	6	3	34	49.8	80.2
4	" "	"	"	9:00	1:04	4	4	4	10	3	54	45.5	73.3
5	" "	"	"	5:30	10:23	4	53	20	26	4	27	39.9	64.3
6	" "	"	"	6:37	11:41	5	4	21	28	4	36	38.6	62.2
7	" "	"	"	12:06	5:29	5	23	19	29	4	54	36.3	58.4

EXPRESS TRAINS FROM NEW YORK (JERSEY CITY) TO WASHINGTON.

Train Number.	Railroad.	Whole Distance.		Time of		Journey Time.		Station-Stops.		Running Time.		Running Speed per Hour.	
		Miles.	Kilometers.	Departure.	Arrival.	Hours.	Minutes.	Number.	Time Lost.	Hours.	Minutes.	Miles.	Kilometers.
535	Royal Blue Line.	229.3	369	1:12	6:00	4	48	7	14	4	34	50.2	80.8
527	" " "	"	"	11:42	4:30	4	48	7	14	4	34	50.2	80.8
509	" " "	"	"	3:12	8:00	4	48	6	13	4	35	50.1	80.6
67	Pennsylvania R. R.	227.4	366	1:14	6:10	4	56	6	14	4	42	48.4	77.9
59	" "	224.4	361	3:44	8:30	4	46	4	6	4	40	48.1	77.4
51	" "	227.4	366	11:14	4:10	4	56	5	11	4	45	47.9	77.1
49	" " "	"	"	10:32	3:40	5	8	5	15	4	53	46.6	75.0
501	Royal Blue Line.	229.3	369	10:12	3:30	5	18	10	22	4	56	46.5	74.9
517	" " "	"	"	8:12	1:40	5	28	20	27	5	1	45.7	73.5
525	" " "	"	"	5:12	10:30	5	18	10	16	5	2	45.6	73.4
45	Pennsylvania R. R.	227.4	366	8:15	1:42	5	27	9	22	5	5	44.8	72.0
503	Royal Blue Line.	229.3	369	7:12	12:50	5	38	10	27	5	11	44.2	71.2
505	" " "	"	"	4:42	10:35	5	53	18	37	5	16	43.5	70.1
31	Pennsylvania R. R.	227.4	366	1:15	6:50	5	35	10	19	5	16	43.1	69.5
35	" " "	"	"	9:15	2:51	5	36	8	17	5	19	42.7	68.8
63	" " "	"	"	4:45	10:20	5	35	4	15	5	20	42.6	68.7
65	" " "	"	"	5:14	10:55	5	41	9	20	5	21	42.5	68.4
57	" " "	"	"	2:32	8:15	5	43	10	22	5	21	42.5	68.4
69	" " "	"	"	3:45	9:29	5	44	6	20	5	24	42.1	67.8
507	Royal Blue Line.	229.3	369	1:42	7:50	6	8	19	39	5	29	41.8	67.4

city to Washington usually reported is the distance from the Calvert street station. The "Congressional Limited," on the Pennsylvania, which is train number 59, does not follow exactly the same route as the other trains on this railway from New York (Jersey City) to Washington. It does not run into the Broad street station in Philadelphia, but stops at the Powelton avenue station, and thus reduces the whole distance by a total of 2.92 miles in running in and out of Philadelphia. Mr. Schulze reports the distance run by this train as 370 kilometers, but the actual distance is 361 kilometers. In the case of the "Royal Blue" trains he understates the distance by two kilometers, although he allows one mile for the Hudson river, for which I allow nothing. The through trains between New York (Jersey City) and Washington over this line do not run into the Reading terminal in Philadelphia, but to the Twenty-fourth and Chestnut streets station. In columns 5 and 6 the boldface type represents afternoon time. By journey-time, as has already been explained, is meant the total time elapsing from the moment of the departure of the train from the initial station to the moment it comes

EXPRESS TRAINS FROM BERLIN TO COLOGNE.

Number.	Route.	Whole Distance.		Time of		Journey Time.		Station-Stops.		Running Time.		Running Speed per Hour.	
		Miles.	Kilometers.	Departure.	Arrival.	Hours.	Minutes.	Number.	Time Lost.	Hours.	Minutes.	Miles.	Kilometers
1	Via Stendal, Hannover, and Essen..... ..	362.1	583	8:55	**5:46**	8	51	11	30	8	21	43.3	69.8
2	Via Magdeburg, Hannover and Essen.....	380.8	613	9:30	7:08	9	38	13	42	8	56	42.6	68.6
3	Via Stendal, Hannover, and Essen	362.1	583	**11:01**	8:00	8	59	6	21	8	38	42.0	67.6
4	Via Stendal, Hannover, and Oberhausen.....	363.9	586	11:45	9:05	9	20	14	40	8	40	42.0	67.6
5	Via Magdeburg, Hildesheim, and Soest....	357.7	576	1:05	**10:26**	9	21	14	35	8	46	40.8	65.7
6	Via Stendal, Hannover, and Oberhausen.....	363.9	586	7:04	11:59	16	55	27	467	9	8	39.9	64.2
7	Via Stendal, Hannover, and Essen.....	362.1	583	9:50	7:51	10	1	19	55	9	6	39.8	64.1
8	Ibid.....	"	"	1:08	**11:00**	9	52	20	44	9	8	39.6	63.8
9	Ibid.....	"	"	7:40	**6:46**	11	6	26	89	9	37	37.6	60.6

to a stop at its final destination. By running-time is meant the journey-time minus the time lost in station-stops. For the trains of this country, this, of course, seldom gives the actual running-time, because of the numerous grade crossings which still exist and which frequently necessitate a full stop. But, as there were usually no data to compute the time thus lost, it was thought best to wholly ignore these stops.

EXPRESS TRAINS FROM NEW YORK TO BUFFALO.

Train Number.	Railroad.	Whole Distance.		Time of		Journey Time.		Station-Stops.		Running Time.		Running Speed per Hour.	
		Miles.	Kilometers.	Departure.	Arrival.	Hours.	Minutes.	Number.	Time Lost.	Hours.	Minutes.	Miles.	Kilometers.
51	N. Y. C. & H. R. R. R.	440.0	708	8:30	4:45	8	15	4	8	8	7	54.2	87.2
9	Lehigh Valley R. R....	446.6	720	12:14	9:55	9	41	13	25	9	16	48.2	77.6
3	Del., L. & W. R. R...	409.0	658	10:15	8:00	9	45	22	30	9	15	44.2	71.2
3	N. Y. C. & H. R. R. R	440.0	708	8:45	7:20	10	35	6	23	10	12	43.1	69.5
11	" " " " " ..	"	"	1:00	11:55	10	55	6	28	10	27	42.1	67.8
19	" " " " " ..	"	"	5:30	4:15	10	45	4	14	10	31	41.8	67.3
1	West Shore R. R.....	428.2	689	3:15	1:50	10	35	8	20	10	15	41.8	67.2
1	Erie R. R.....	423.0	681	9:15	8:00	10	45	19	27	10	18	41.1	66.1
17	N.Y. C. & H. R. R. R.	440.0	708	4:00	3:10	11	10	13	25	10	45	40.9	65.9
7	Lehigh Valley R. R....	446.6	720	8:15	7:55	11	40	16	45	10	55	40.9	65.9
9	Del., L. & W. R. R...	409.0	658	9:00	7:45	10	45	21	33	10	12	40.1	64.5
29	N. Y. C. & H. R. R. R.	440.0	708	8:00	7:25	11	25	10	24	11	1	40.0	64.3
21	" " " " " ..	"	"	2:00	1:30	11	30	15	27	11	3	39.9	64.1
33	" " " " " ..	"	"	9:20	8:45	11	25	6	20	11	5	39.7	63.9
19	West Shore R. R.....	428.0	689	8:30	7:55	11	25	9	33	10	52	39.4	63.5
7	Erie R. R.....	423.0	681	7:45	7:05	11	20	14	26	10	54	38.8	62.5
23	N. Y. C. & H. R. R. R.	440.0	708	6:00	6:00	12	0	9	26	11	34	38.0	61.2

I believe it has now been shown that Mr. Schulze's table neither furnishes the promised "safe and satisfactory guide to the speed of American trains" nor a proper basis for a comparison of the speed of American and German express trains. Perhaps it has also appeared, as the discussion proceeded, that the statistical matter appearing in at least one scientific journal, as well as that which found a place in some American and foreign newspapers, greatly needs verification before it can be accepted.

GEORGE G. TUNELL.

CHICAGO.